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13. ABSTRACT (Maximum 200 Words)
Between 1991 and 1997, the rate of mammography among uninsured women decreased in 30% of states. This decline may be due to the influx of managed care in many communities, which has eroded the ability of uninsured women to receive primary care, reduced the availability of mammography facilities, and increased waiting times for mammography. In this study, we examined whether there was an association between managed care penetration and rates of mammography among uninsured women between 50 and 64 years of age. We compared these rates to mammography rates for women aged 50 - 69 with private or public coverage, including Medicare. To examine these hypotheses, we conducted a longitudinal study using data from the Center for Disease Control and Prevention's (CDC's) Behavioral Risk Factor Surveillance System (BRFSS), and InterStudy for the years 1997 to 2000. Based on results from longitudinal models of mammography use on managed care penetration, we found that managed care penetration had no significant effect on mammography use for women, regardless of their insurance status. The results of our study suggest that the financial incentives created by managed care in a market do not lead to a reduction in service use. Furthermore, our results suggest that the reduction in the number of mammography providers found in earlier research does not threaten access to mammography.

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Introduction

During the 1990s, while the rate of mammography rose in the overall population, the rate of mammography among uninsured women decreased in 30% of states. During the same period, the presence of managed care was rapidly increasing. Prior research suggests that managed care penetration can affect spending and access to providers even outside of the managed care population.[1-4] Given evidence that managed care has reduced the availability of mammography facilities, and increased waiting times for mammography[3], the decline in mammography among the uninsured could be related to the influx of managed care in many communities. In this study, we examined whether there was an association between managed care penetration in an area and rates of mammography among uninsured women between 50 and 64 years of age. We compared these rates to mammography rates for women aged 50-74 with private insurance, Medicaid, or Medicare. We hypothesized that rates of annual mammography among uninsured women would grow more slowly or decline in areas with high rather than low managed care penetration, and that changes in the rate of mammography among uninsured women in areas of high managed care penetration would be partially explained by reduced receipt of primary care and access to mammography facilities. To examine these hypotheses, we conducted a longitudinal study using data from the Center for Disease Control and Prevention's (CDC's) Behavioral Risk Factor Surveillance System (BRFSS) and InterStudy data on managed care enrollment for the years 1997 to 2000. We used longitudinal models of mammography receipt to determine whether increasing managed care penetration explained the declining use of screening mammography among uninsured women.

Body

Overview of key personnel and activities

As of our annual report filed in June, 2002, we had begun to assemble the data needed for analysis, and we had delayed our analysis due to problems accessing data on the location of mammography facilities from the Food and Drug Administration. As reported in our annual report, because of the delay in obtaining data and difficulty obtaining earlier data, we changed our study period to a more recent period (1997 – 2000). Since June of 2002, the key personnel (those receiving payment on the project) have worked to revise our research design and implement the planned analyses. The key personnel include: Pushkal Garg, Mary Beth Landrum, Ellen Meara, and Jeff Souza. An additional researcher, Ed Guadagnoli contributed his time to the project without pay.

When meeting as a research team, we decided that it would be most useful to understand the impact of managed care on mammagraphy use for all women, stratified by insurance status, to provide a reference point for our results on uninsured women. Also, after filing our annual report, we found that the geographic identifiers for Metropolitan Statistical Areas available in the BRFSS were somewhat limited, and we did not feel that the individuals who could be linked to an MSA would allow for a representative sample of women. We therefore focused all further efforts on analyses including women with private insurance, Medicare, Medicaid, in addition to the uninsured. We also conducted all further analyses linking women to county-level managed care penetration, where the link between the BRFSS and county level data was more reliable.

Our overall approach to the project was to estimate how mammography receipt (defined as receiving a mammogram within the past 2 years) varied as a function of managed care penetration in one's county of residence. Using BRFSS data on mammography and detailed characteristics about study respondents linked to InterStudy data on managed care penetration in a county, we estimated both cross-sectional and longitudinal models of mammography receipt. Our approach and findings are described in detail below.

Sample

We formed our study sample based on women in the BRFSS. From 372,057 women in the 1997 to 2000 BRFSS, we excluded 112,052 people because they were missing geographic identifiers (county codes) that would allow us to match them to the InterStudy managed care penetration rate file. Of these people, 86% did not match because the county code was missing on the survey file, and the rest because county codes on the survey file did not match the penetration rate file. Of the remaining 260,005 women 71,660 made it into the final model. Women were excluded from the sample if they had any of the following (non-mutually exclusive) characteristics: age under 50 or over 74 (179,946), missing insurance variable (7,834), missing mammography variable (2,451), missing race (1,451), missing Hispanic status (1096), missing education (549), missing marital status (731), missing employment status (10,049), missing smoking status (47).

Variable definition

Our dependent variable of interest is mammography receipt. We define our mammography variable as an indicator equal to 1 if respondents report that they have received a mammogram within the past 2 years and 0 otherwise. Our independent variables of interest are managed care penetration in a county, based on the number of persons in a county enrolled in managed care, divided by the total population in that county as of January 1st in the following calendar year. In other words, managed care penetration for the 1997 survey is linked to managed care enrollees as of January 1, 1998. In our multivariate models of mammography receipt, we included dummies to indicate whether a respondent's county of residence had managed care penetration rates of: less than 10%, 10-30%, and greater than 30%. We selected these cutoffs to allow the effect of managed care to vary depending on the level of managed care while maintaining parsimony in our models.

To define insurance status, we used several questions available in the BRFSS. The survey asks, "Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare?" For those who say yes, they are asked "Do you have Medicare?" and if respondents do not say they have Medicare, they are asked "What type of health care coverage do you use to pay for most of your medical care? Please tell me if you have coverage through any of the following: your employer, someone else's employer, a plan that you or someone else buys on your own, Medicare, Medicaid or medical assistance, the military, Champus, or the VA, the Indian Health Service, Some other source," For those who say they do not have health coverage, respondents hear the following: "There are some types of coverage you may not have considered. Please tell me if you have coverage through any of the following: your employer, someone else's employer, a plan that you or someone else buys on your own, Medicare, Medicaid or medical assistance, the military, Champus, or the VA, the Indian Health Service, Some other source, Don't know/not sure, or none." We defined respondents as uninsured if they answered that they had no coverage and if they did not describe

any source of coverage in response to the follow-up question on types of coverage they have not considered.

Each multivariate model also controlled for the following variables: age (5-year age groups), race (binary variables for Black, Asian, or Native American race), a binary variable for Hispanic origin, education (binary variables for high school, some college, or college degree), a binary variable for whether respondent is married, a binary variable for whether respondent is employed, whether respondent is retired, whether respondent is a current smoker, whether respondent is a former smoker, indicator for income categories in $1,000s (10-15, 15-20, 20-25, 25-35, 35-50, 50-75, over 75, and missing).

Table 1 shows summary statistics of our sample of 71,660 women aged 50-74. The average rate of mammography across our sample is 82 percent. About six percent of our sample, or 4,142 women are uninsured. Just over half the sample of women live in counties where managed care penetration exceeds 30 percent.

Statistical analysis

We first summarized the data by comparing mammography receipt in 1997 and 2000 for different levels of managed care penetration stratified by insurance status. We then estimated cross-sectional models of mammography receipt on managed care penetration in a county. Because cross-sectional models of mammography receipt as a function of managed care in an area may suffer from confounding due to unobserved characteristics in counties that are correlated both with managed care penetration in that county and mammography receipt, we then ran longitudinal, fixed effect models of mammography receipt.

This method differed slightly from our planned hierarchical models because our proposed models were not feasible given the large number of observations (71,660) and counties (856) in our data. By estimating a fixed effect model which includes a dummy variable for each county in our data (with one county omitted), we address some of the potential confounding in a cross-sectional model. The county fixed effects control for fixed, unobserved characteristics in a county that may be correlated with both managed care penetration and mammography receipt. For ease of interpretation, the results presented here are for linear probability models with fixed county effects, though the results are similar using alternative methods of estimation such as logistic models with fixed county effects. Our longitudinal models adjust standard errors for correlation of observations within counties. All statistics shown in all tables are computed using the sample weights provided in the BRFSS to make estimates comparable to the non-institutionalized U.S. population.

Table 1: Sample characteristics for 71,660 women aged 50-74 in the Behavioral Risk Factor Surveillance System

Variable	Mean
Mammogram within past 2 years	.815
Age	
50-54	.254
55-59	.199
60-64	.157
65-69	.203
Insurance status	
Uninsured	.057
Medicare	.386
Medicaid	.012
Managed Care Penetration	
10-30% Managed Care Penetration in County	.361
Over 30% Managed Care Penetration in County	.561
Year	
1998	.251
1999	.246
2000	.263
Black	.104
Asian	.024
Native American	.008
Other race	.017
Hispanic	.073
Education	
High school degree	.363
Some collete	.258
College degree	.246
Married	.618
Employed	.452
Retired	.376
Current smoker	.159
Former smoker	.297
Income	
$10,000-$15,000	.053
$15,000-$20,000	.076
$20,000-$25,000	.093
$25,000-$35,000	.141
$35,000-$50,000	.149
$50,000-$75,000	.122
$75,000 and higher	.119
Missing income	.200
Reside in rural county	.245

Results

Tables 2 and 3 show how mammography receipt varies with managed care penetration. Within all age groups and any insurance status, mammography receipt is higher in counties with higher levels of managed care penetration. Mammography receipt is significantly lower, about 27 percentage points lower, for uninsured women than for women with public or private insurance coverage.

Table 2: Share of women who report having a mammogram within past 2 years

	Percent of County Population Enrolled in Managed Care				
Year	<10%	10-20%	20-30%	30-40%	40+%
1997	.76	.81	.82	.82	.82
2000	.76	.81	.82	.82	.83

Table 3: Managed care penetration and share of women who report having a mammogram within past 2 years, by insurance status and age

	1997				
	Percent of County Population Enrolled in Managed Care				
Insurance	<10%	10-20%	20-30%	30-40%	40+%
Private	.81	.84	.85	.85	.86
Medicare	.76	.82	.82	.81	.82
Medicaid	.68	.62	.74	.83	.73
Uninsured	.47	.52	.54	.55	.47
	2000				
	Percent of County Population Enrolled in Managed Care				
Insurance	<10%	10-20%	20-30%	30-40%	40+%
Private	.81	.83	.85	.85	.87
Medicare	.77	.81	.82	.81	.84
Medicaid	.63	.69	.78	.76	.76
Uninsured	.47	.52	.54	.52	.47

Table 4 displays results based on cross sectional models of mammography receipt controlling for the covariates described above. The predicted probability of mammography receipt shown in the table represents the estimated probability of receiving mammography for a hypothetical white, non-smoking, non-employed, married woman with a high school degree, and household income between $25,000-$35,000.

Table 4: Probability of mammography receipt by level of managed care penetration in county, based on cross-sectional models

	Managed care penetration in county of residence		
Insurance Status	Less than 10%	10-30%	Over 30%
Private	.78	.80	.82
Medicare	.74	.78	.79
Medicaid	.71	.76	.79
Uninsured	.50	.58	.50

Based on linear probability models of mammography receipt described in the text, table shows the probability of mammography receipt for a hypothetical woman with the following characteristics: white, married, non-smoker with a high school degree, aged 60-64, income $25,000-$35,000, and not employed. Based on two-tailed t-tests, both the differences in mammography rates by managed care penetration (differences across columns) and differences in mammography receipt across insurance groups (differences across rows) are statistically significant (at the .05 level).

In a cross-sectional model controlling for characteristics described above in the text, the relationship between mammography and managed care penetration by insurance status mirrors that shown in tables 2 and 3. Women are significantly more likely to receive mammography in counties with higher levels of managed care penetration, but regardless of managed care penetration in a county, uninsured women are significantly less likely to receive mammography. If women in counties with higher managed care penetration have better access to care or a higher propensity to seek basic clinical services such as mammography, cross-sectional estimates of managed care penetration's effect on mammography will be confounded by these unobserved differences across counties. Therefore, we exploit the time series nature of our data to run longitudinal models of mammography receipt.

Table 5 shows the probability of mammography for a similar hypothetical white, married, non-smoking, non-employed woman with household income between $25,000 and $35,000. In a longitudinal model, which essentially estimates the impact of changes in managed care penetration on mammography receipt, there is no significant difference in mammography receipt between women living in high (over 30 percent) versus low (under 20 percent) managed care penetration. This absence of an association between managed care penetration and mammography is the same regardless of insurance status.

Table 5: Probability of mammography receipt by level of managed care penetration in county, based on longitudinal models

	Managed care penetration in county of residence		
Insurance Status	Less than 10%	10-30%	Over 30%
Private	.83	.82	.81
Medicare	.82	.81	.80
Medicaid	.81	.74	.82
Uninsured	.56	.56	.57

Table shows the probability of mammography receipt for a hypothetical woman with the following characteristics: white, married, non-smoker with a high school degree, aged 60-64, income $25,000-$35,000, and not employed. Based on two-sided t-tests in our regression models, the differences in mammography rates by managed care penetration (differences across columns) are not statistically significant (at the .05 level), while differences in mammography receipt across insurance groups (differences across rows) are statistically significant.

Based on results suggesting that managed care does not affect mammography receipt for uninsured women, we did not fit proposed models of the mechanisms linking managed care to mammography receipt. If anything, managed care depresses mammography receipt slightly for privately insured women and women in Medicare, while having no effect on uninsured women.

Key Research Accomplishments

Our key research accomplishments include:

- Completed cleaning of BRFSS surveys 1997-2000 to make variables comparable across years, and coding variables for use in our analyses.
- Constructed analytical data set linking sample of women aged 50 to 74 in the BRFSS to managed care penetration data, linking on the county of residence of survey respondents.
- Compiled cross-tabulations of major variables of interest, mammography receipt and managed care penetration.
- Performed multivariate, cross-sectional analyses of mammography receipt as a function of managed care penetration in a county and insurance status, as well as the interaction between insurance status and managed care penetration.
- Performed longitudinal analyses of mammography receipt as a function of managed care penetration in a county and insurance status, as well as the interaction between insurance status and managed care penetration.

Reportable Outcomes

We are in the process of preparing a manuscript summarizing our findings for publication. The key outcomes reported in our manuscript include:

- Mammography receipt is significantly lower for uninsured women compared with women privately insured or covered through Medicare and Medicaid.

- Managed care penetration is associated with greater use of mammography in a cross-sectional comparison of mammography rates by level of managed care penetration.

- In a longitudinal analysis that addresses possible confounding present in cross-sectional comparisons of managed care penetration and mammography, managed care penetration in a county has no significant effect on mammography receipt among uninsured women.

- Compared to uninsured women, women with private insurance or Medicare are slightly less likely to receive mammography in counties with high levels of managed care penetration.